# PLANT FOSSILS OF THE PENNSYLVANIAN SYSTEM OF GEORGIA

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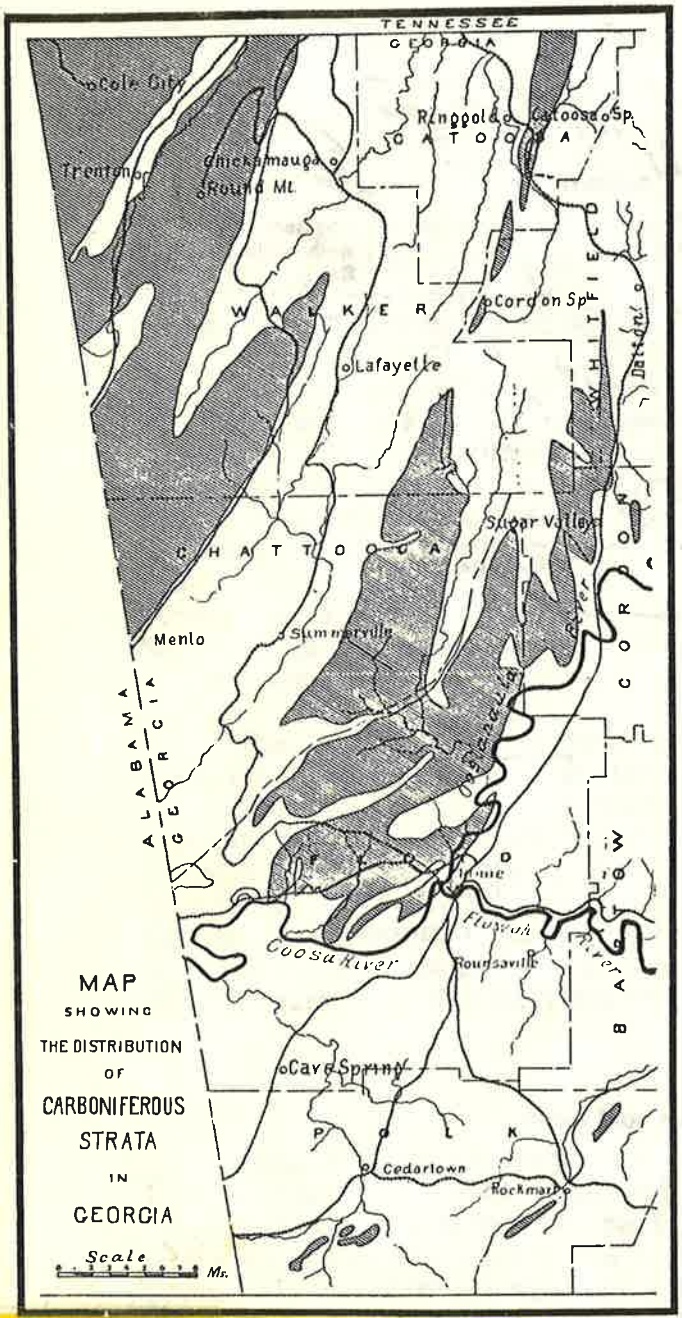

McCallie, 1904, Coal Deposits
rgia, Geological Survey of Georgia.

**Premeeting Field Trip: "The Pennsylvania System in Georgia: Stratigraphy, Structure, Paleontology and Coal Resources"**

**Guidebook Addendum**
**38th Annual Meeting**
**Southeastern Section**
**The Geological Society of America**
**Atlanta, Georgia**
**April 3-5, 1989**

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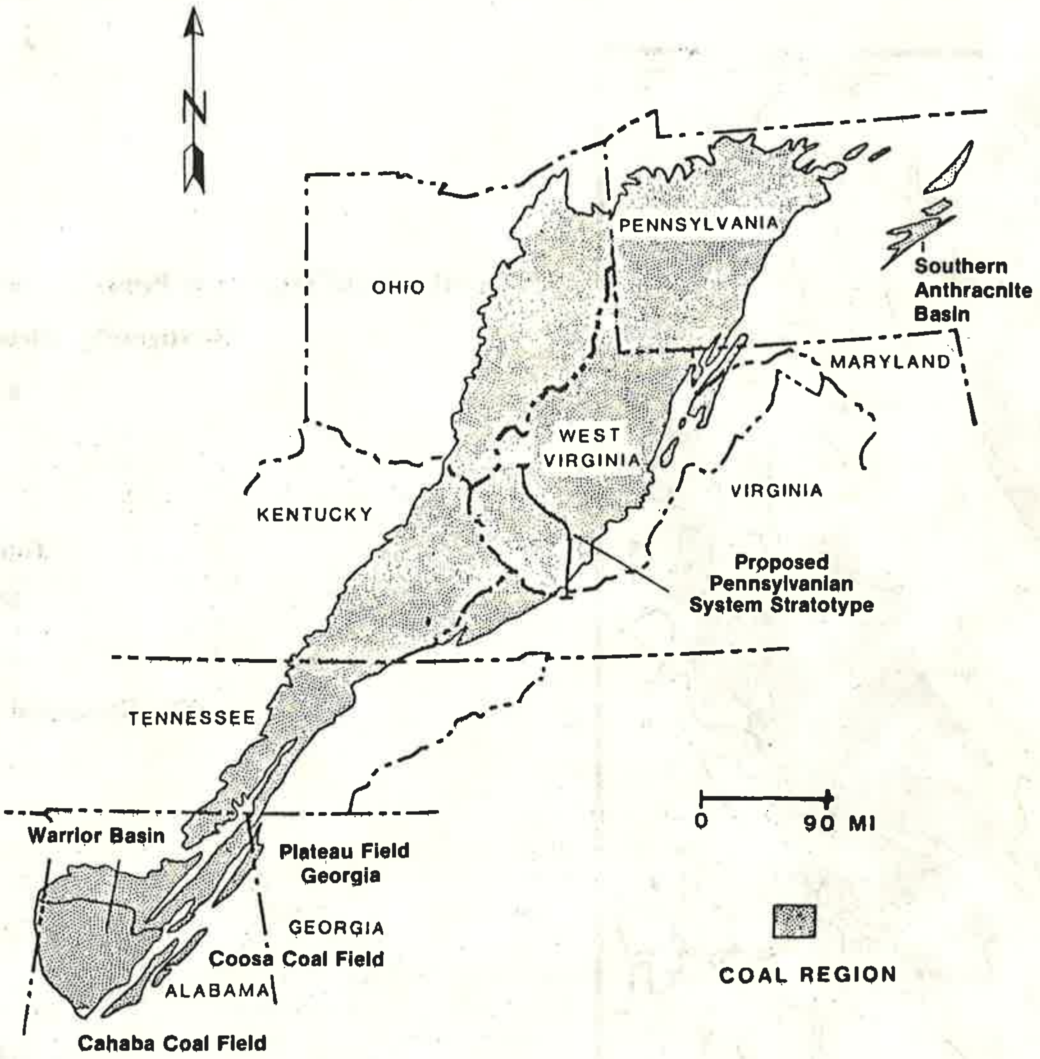

Figure 1. The Appalachian coal basin.

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## Introduction

During Late Mississippian and Early Pennsylvanian time, the shallow, slowly subsiding Appalachian basin extended from Alabama through northwestern Georgia, east central Tennessee, eastern Kentucky, southwestern Virginia, West Virginia, eastern Ohio, and western Pennsylvania [Figure 1].

The Pennsylvanian strata that developed during this time in what is now the State of Georgia are preserved in synclinal folds that cap roughly flat-topped mountains. These are the youngest Paleozoic strata in Georgia and are part of a belt, consisting almost entirely of clastic rocks, that extends from the northern end of Sand Mountain and Lookout Mountain near Chattanooga, Tennessee, across northwestern Georgia and on into Alabama (Thomas and Cramer, 1979, p. H-5; Crawford, 1989). In addition to Sand and Lookout Mountains, small outliers of Pennsylvanian strata occur on Sand Mountain in Catoosa County, Little Sand Mountain in Chattooga County, and Rocky Mountain in Floyd County. Fox Mountain in Dade County is an isolated remnant of Sand Mountain [Figure 2].

The contact in Georgia between the Pennsylvanian and the underlying Mississippian occurs in an interval of coarse clastics and is not clearly identifiable. The oldest Pennsylvanian plant fossils occur in lithologies very similar to those in which the youngest Mississippian age fossils are found and in some instances only a few to several feet separate these fossiliferous horizons. The early Pennsylvanian age for the coals is based on plant compression floras, palynomorphs, and invertebrate marine assemblages. Most of the plant megafossils are found in shales and siltstones associated with the several coal beds [Figure 3]. The palynomorphs were macerated from the coals.

## Previous Reports

Lesquereux's comprehensive work, generally referred to as the "Coal Flora" (Lesquereux, 1880, 1844), summarizes North American compression flora knowledge to that time. On page 852, he lists 27 species from somewhere in Dade County, Georgia, but miscorrelates the flora with strata in Pennsylvania which have since proven to be of Mississippian age. David White (1900, p. 817), using fossil megaplant evidence, correlated the Pennsylvanian rocks of Georgia with Early Pottsvillian rocks that occurred to the northeast in West Virginia and in eastern Pennsylvania where the type locality of the Pottsville Formation occurs in the

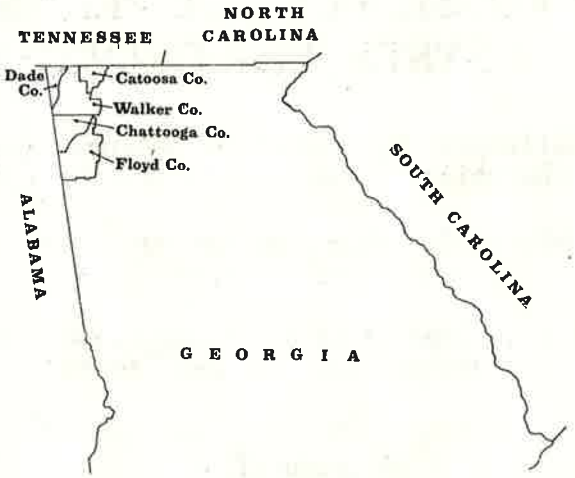

Figure 2. Location of Pennsylvanian strata in Georgia.

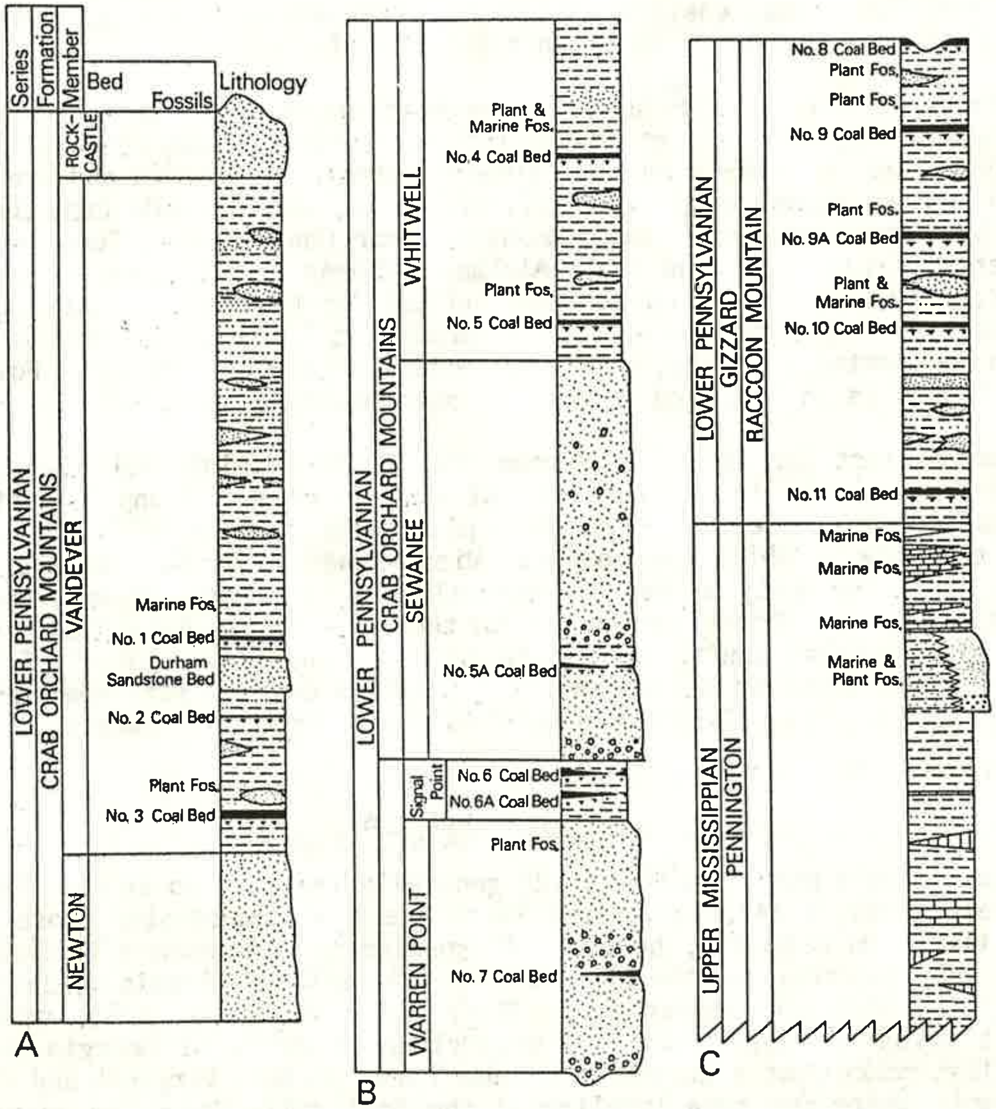

Figure 3. Geologic column showing location of the coal beds and fossil localities in the upper Mississippian and Pennsylvanian of Georgia.

southern anthracite coal field. White later (1943) correlated the Number 3 coal bed near Durham, Georgia, as Early, although probably not earliest, Pottsvillian.

In 1954, Allen and Lester, in a study of the paleontology of the rocks of northwest Georgia, illustrated 23 species assembled from mine dumps. The names provided are greatly in error and the parent geologic horizons are uncertain.

In 1964, Read and Mamay published their Upper Paleozoic Floral Zones and Floral Provinces of the United States, but didn't include data from Georgia, except by implication through the coverage of neighboring Alabama and Tennessee. Wanless (1975, p. 32), in the U.S. Geological Survey's massive summary of the Pennsylvanian System in the United States, concluded that the Pennsylvanian rocks of Georgia should, on the basis of contained plant fossils, be correlated with the Early Pennsylvanian.

In 1972, Gillespie and Pfefferkorn (1977, 1979) began their study of the plant fossils of the proposed Pennsylvanian System stratotype (Englund, *et al*., 1979) in Virginia and West Virginia. They later used the newly collected information and that in the literature to draw conclusions as to the biostratigraphy and biogeography of plant compression fossils in the Pennsylvanian of North America (Pfefferkorn and Gillespie, 1980). This study showed the lack of fossil data on the southern Appalachians; so an effort was initiated to expand the Pennsylvanian System stratotype project into the states of Tennessee, Georgia, and Alabama. This more or less coincided with the U. S. Geological Survey's coal investigation and geological mapping program in Georgia, which was started in 1977 (Crawford, 1989; Coleman, Crawford and Medlin, 1986).

In 1983, Gillespie and Crawford prepared a preliminary report on plant megafossils from the Carboniferous of Georgia and in 1985, Eble, Gillespie, Crawford and Rheams published on the miospores found in the coals and carbonaceous shales of Alabama and Georgia. Gillespie and Rheams (1983) compared the plant megafossil occurrences in the Carboniferous of Alabama with other Appalachian areas, including Georgia.

## Mississippian Plant Megafossil Collections

Historically, the systemic boundary between the Mississippian and Pennsylvanian in Georgia has been placed at the contact between the Pennington Formation and the Raccoon Mountain Member of the Gizzard Formation (Thomas and Cramer, 1979, p. H-31). Both plant and animal fossils are rare in the vicinity of the presumed boundary, although careful searches have been made. Consequently, as a general concept, the boundary is not specifically mappable in Georgia.

An assemblage collected from near Hale Gap in Dade County is the most extensive flora yet found in Upper Pennington strata. Many of the elements are not stratigraphically diagnostic, but the presence of *Archaeopteridium tschermacki* (Stur) Kidston and *Sphenopteris* cf. *elegans* (Brongniart) Sternberg are enough to conclude that the flora is Upper Mississippian. The assemblage also contains cupules, aphleboid structures, trigonocarpalean seeds, *Stigmaria ficoides* (Sternberg) Brongniart, *Calamites* sp., *Cordaites* sp. and a new leaf genus that will be named *Kenenglundii penningtonensis* (manuscript). The flora is equivalent to the Late Mississippian age Bluestone Formation of West Virginia (Gillespie and

Pfefferkorn, 1977) and the flora occurring just below the Mississippian-Pennsylvanian boundary in the Parkwood Formation near Birmingham, Alabama (Henry, *et al*., 1985). As discussed elsewhere in this fieldguide, invertebrate collections also indicate a Late Mississippian age for these strata.

A new lycopod from the Upper Mississippian near Ringgold, Georgia, is being studied by others (Brack-Hanes, *et al*., 1983).

We have also collected a flora from approximately 31 meters above the base of the Raccoon Mountain Member at its type locality in Scratch Ankle Hollow near Trenton, Georgia, where it conformably overlies the Pennington. This sparse assemblage came from a bay-fill deposit near the horizon of the Number 10 or Red Ash coal. It contains *Neuropteris pocahontas* David White and *N. smithii* Lesquereux and so is definitely Lower Pennsylvanian.

The Hale Gap and Scratch Ankle Hollow floras substantiate the traditional placement of the Mississippian-Pennsylvanian boundary in Georgia as being at or near the contact between the Pennington Formation and Raccoon Mountain Member of the Gizzard Formation.

## Pennsylvanian Plant Megafossil Collections

The plant megafossil collections from Pennsylvanian strata in Georgia are from shales (roof rock) and silt stones associated with coal beds. The most extensive floras have been found in association with the Number 3 coal bed of the Vandever Member and the Number 5 coal of the Whitwell Member of the Crab Orchard Mountains Formation. Plant megafossils have not been found in the Newton or Rockcastle Members of the Crab Orchard Mountains Formation [Figure 3].

The plant megafossils considered to be common include *Sigillaria elegans* Brongniart, *Lepidophloios laricinus* Sternberg, *Lepidodendron aculeatum* Sternberg, *L. obovatum* Sternberg, *Calamites cistiiformis* Stur, *Calamites* spp., *Asterophyllites charaeformis* (Sternberg) Goeppert, *A. grandis* Sternberg, *Annularia asteris* Bell, *Sphenophyllum cuneifolium* (Sternberg) Zeiller, *Neuropteris pocahontas* David White, *N. smithii* Lesquereux, *N.* cf. *hollandica* Stockmans, *N.* cf. *heterophylla* Brongniart, *Sphenopteris hoeninghausii* (Brongniart) Potonie, *S. pottsvillea* (David White) Gastaldo and Boersma, *Alethopteris lonchitica* (Schlotheim) Sternberg, *Holcospermum* sp., *Eremopteris* sp. and *Cordaites* sp.

Others occurring commonly at one or more horizons, but not generally throughout the column, include *Neuralethopteris larishii* Susta, *Alethopteris valida* Boulay, *Zeilleria delicatula* (Sternberg) Kidston, *Sphenophyllum tenue* David White, *Alethopteris decurrens* (Artis) Zeiller, *Diplothmena cheathami* (Lesquereux) David White, *Aneimites pottsvillensis* David White, *Palmatopteris furcata* (Brongniart) Potonie, *Eusphenopteris aldrichii* (D. White) Van Ameron, *Annularia radiata* (Brongniart) Sternberg, *Asterophyllites equisetiformis* (Sternberg) Brongniart and *Alloiopteris* cf. *georgiana* Lesquereux. Still others occur sporadically.

The many floras are overall remarkably similar. Exceptions are when *Zeilleria delicatula*, usually associated with the Number 5 coal, and *Sphenophyllum tenue*, usually associated with the Number 3 coal, are present because either can be so abundant as to virtually exclude other plants.

## Pennsylvanian Miospore Collections

A total of 76 species in 33 miospore genera were identified from macerations of 51 samples of coal and carbonaceous shales collected in Georgia and Alabama. These included the 11 coals of Georgia, representatives of all of the coal groups of Alabama, and the presumably youngest and oldest Pennsylvanian strata of each state (Eble *et al*, 1983). In general, the same microfloral assemblages were found throughout, although the high rank of the Georgia coals often reduced recovery and/or resulted in fragmented specimens.

## Plant Biostratigraphy

Important elements in the plant megafossil assemblages from the coal-bearing strata of northwestern Georgia are *Sigillaria elegans*, *Lepidodendron obovatum*, *Sphenopteris hoeninghausii*, *Neuropteris pocahontas*, *N. smithii*, *Alethopteris valida*, *Neuralethopteris larishii* and *Zeilleria delicatula*. These indicate that the rocks are of Early, but not earliest, Pennsylvanian age when compared with those from the proposed Pennsylvanian System stratotype in West Virginia and Virginia (Gillespie and Pfefferkorn, 1979; Pfefferkorn and Gillespie, 1982) [Figure 4]. When compared with European floras, these correlate with the uppermost Namurian C and Westphalian A chronostratigraphic zones (Wagner, 1984) [Figure 5]. These floras are virtually identical to those found with the Baldwin coal (Upper Morrowan Hogseye flora) of Arkansas, the Upper Morrowan generally of the Illinois basin, the entire Pennsylvanian section in Alabama, the Gizzard and lower part of the Crab Orchard Mountains Formations of Tennessee, the Lower New River Formation of West Virginia, and the Lykens Valley 1, 2 and 3 coals in the southern anthracite basin of eastern Pennsylvania. Additional evidence of age comes from the palynological zonations of Smith and Butterworth (1967), Owens (1984) and Peppers (1984), who show that the *Schulzospora rara* - *Radiizonates striatus* assemblage, which is present throughout the Pennsylvanian strata of Alabama and Georgia, is indicative of the Westphalian A of Great Britian, Western Europe, and the Donetz basin and to the Upper Morrowan of the Illinois basin. Eble *et al* (1983) have shown that this microflora characterizes the Upper Lower Pennsylvanian (New River Formation) of the proposed Pennsyvlanian system stratotype of Virginia and West Virginia. Also, the first appearance of statistical amounts of *Laevigatosporites* in the Number 3 coal of Georgia and the Brookwood coal of Alabama, indicates that these younger beds correlate with the Sewell (=Sharon) coal interval of Upper Middle New River Age in western Pennsylvania, northern West Virginia, and eastern Ohio.

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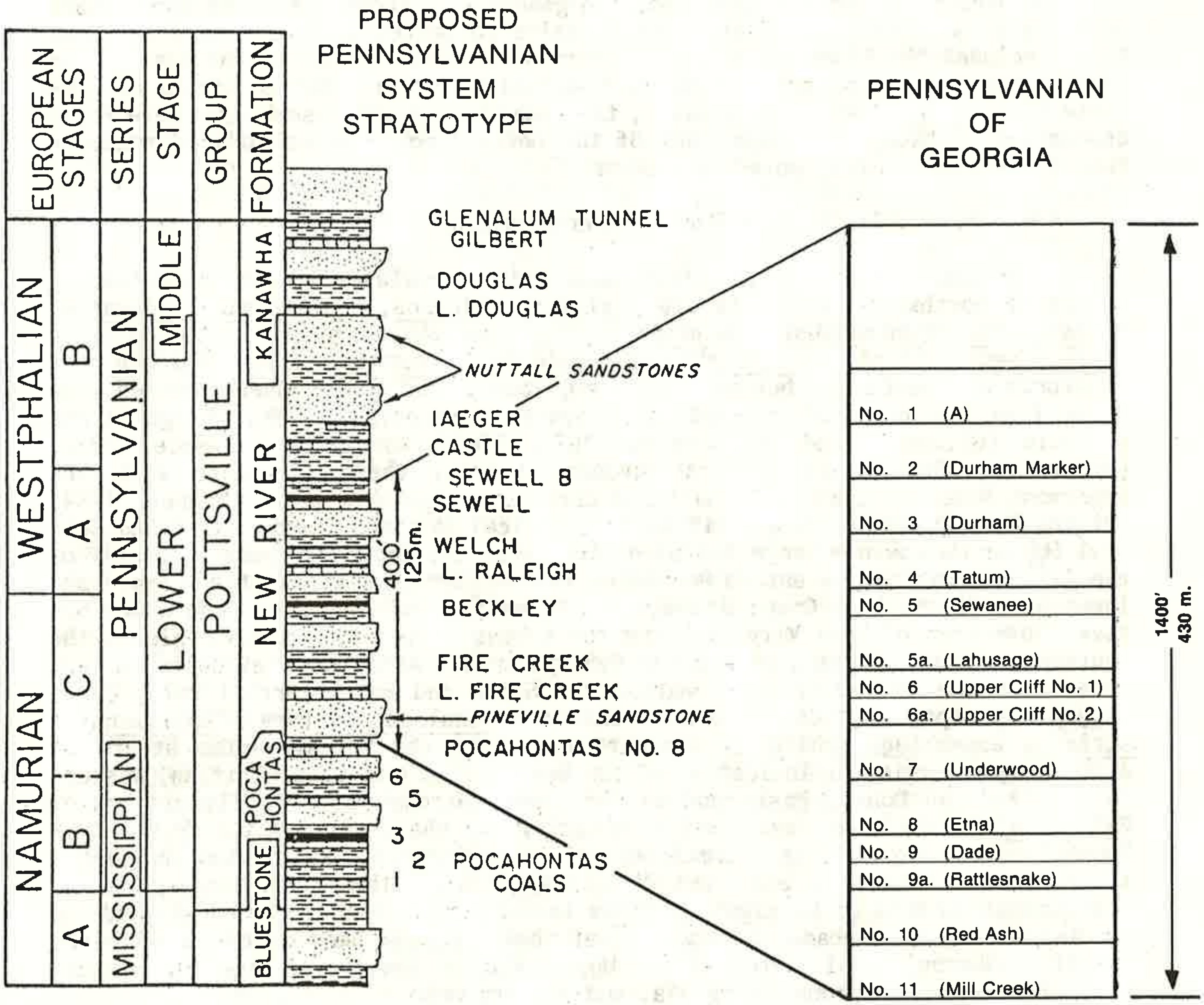

**Figure 4.** **Relative position of the Pennsylvanian of Georgia in relation to the proposed Pennsylvanian stratotype of Virginia and West Virginia.**

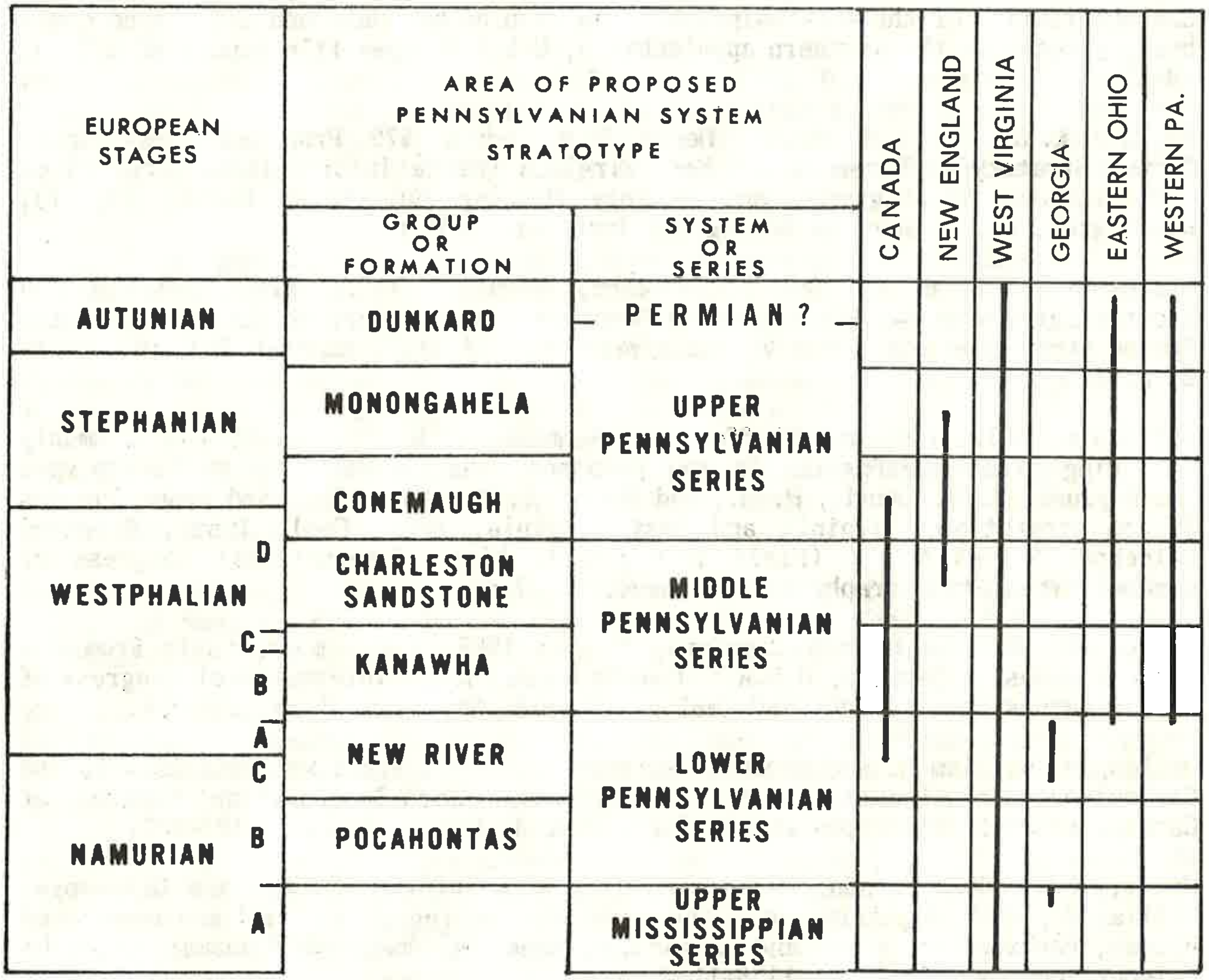

**Figure 5.** Relative age of the coal beds of Georgia as contrasted to those of other states in the Appalachian coal basin, New England, Canada, the proposed Pennsylvanian stratotype of Virginia and West Virginia and European stages.

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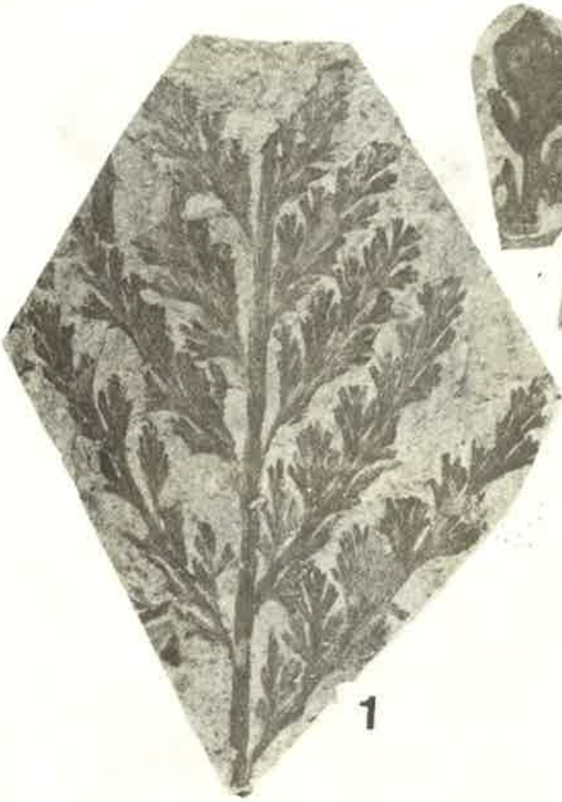
## THE FOLLOWING ARE SOME OF THE PLANT FOSSILS THAT YOU WILL BE ABLE TO SEE AND COLLECT ON THE FIELDTRIP.

### Plate 1

1. Archaeopteridium tschermacki
2. New genus A. - manuscript name Kenenglundii penningtonensis
3. Neuropteris pocahontas
4. Holcospermun maizeretense
5. Aulacotheca campbelli
6. Asterophyllites equisetiformis
7. Sphenopteris pottsvillea
8. Asterophyllites charaeformis
9. Alloiopteris georgiana
10. Palmatopteris furcata
11. Lepidodendron aculeatum
12. Lepidophloios laricinus
13. Lyginopteris hoeninghausii - stem
14. Sphenopteris hoeninghausii
15. Neuralethopteris larishii

### Plate 2

1. Calamites sp.
2. Zeilleria delicatula
3. Sigillaria elegans
4. Sphenophyllum tenue
5. Lepidodendron obovatum
6. Lepidodendron twig
7. Alethopteris lonchitica x2
8. Lycospora (spore) - greatly enlarged
9. Radiizonates striatus (spore) - greatly enlarged
10. Schulzospora rara (spore) - greatly enlarged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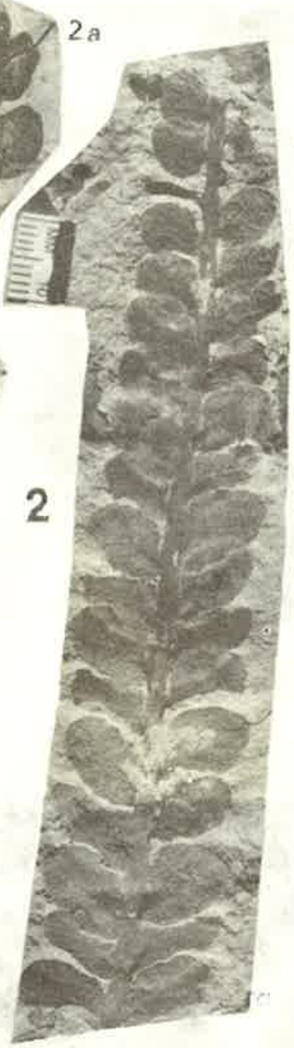
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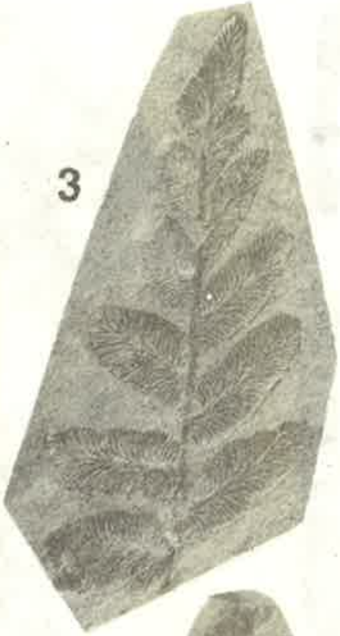
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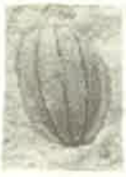
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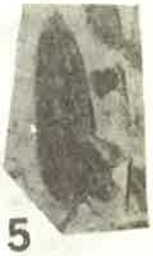
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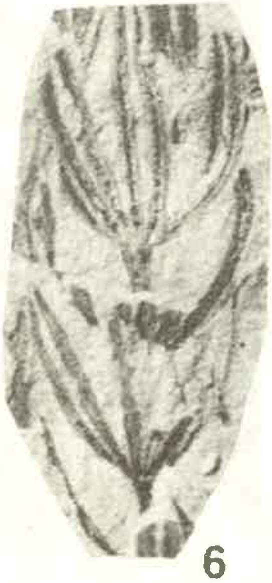
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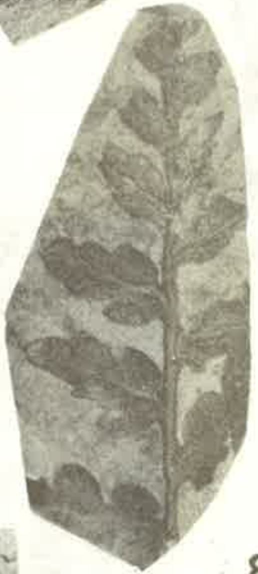
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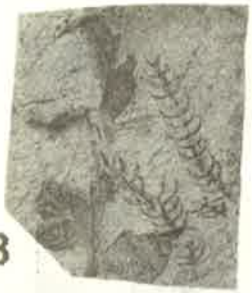
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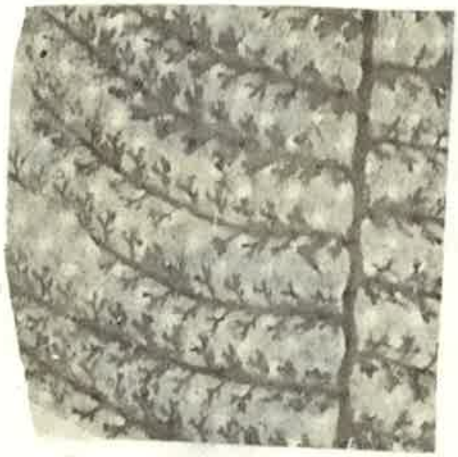
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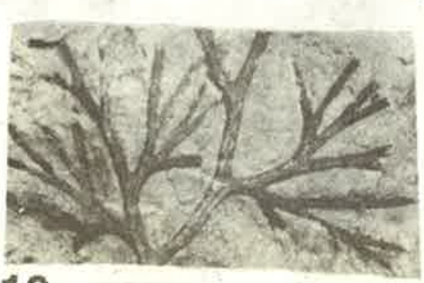
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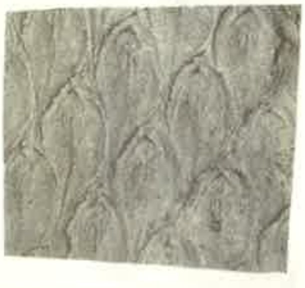
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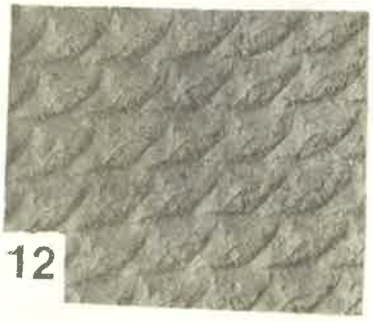
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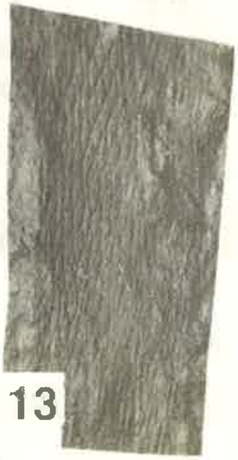
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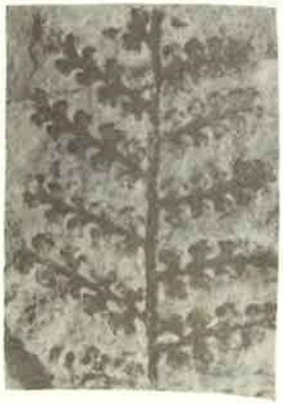
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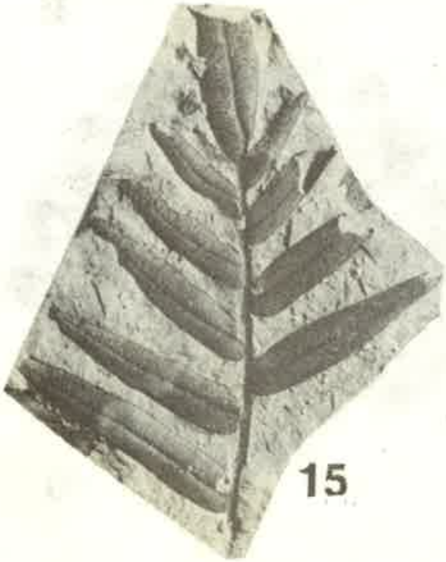
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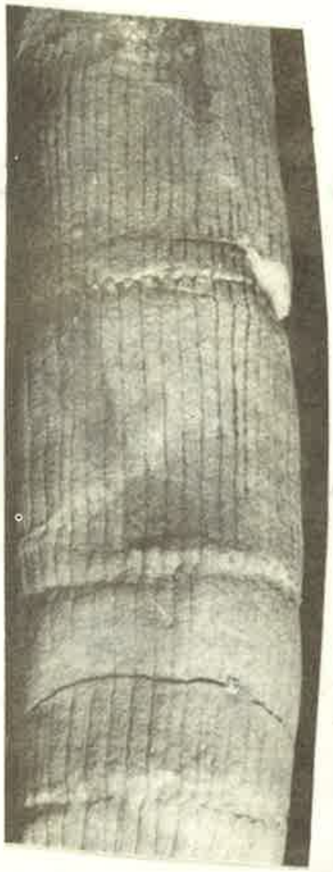
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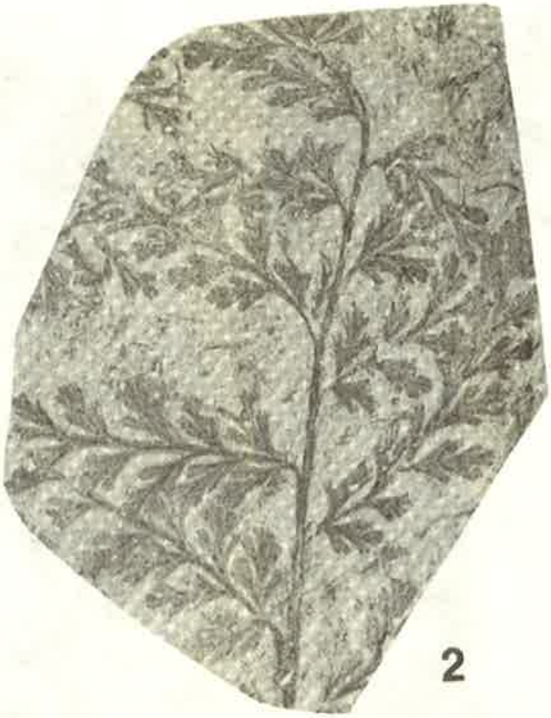
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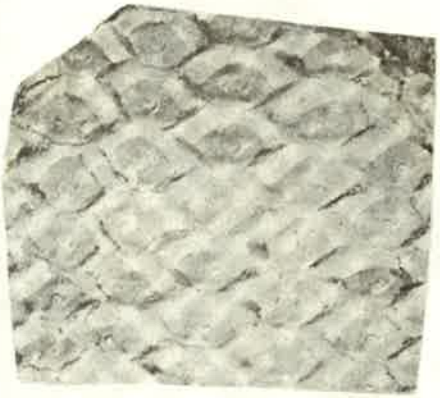
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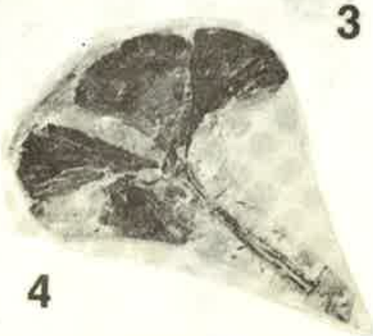
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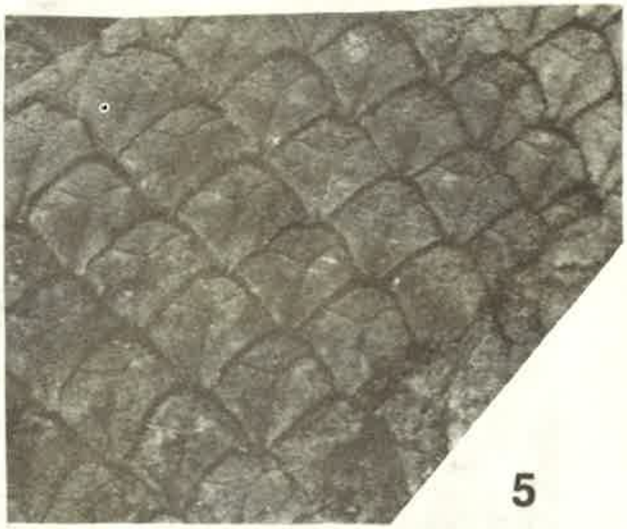
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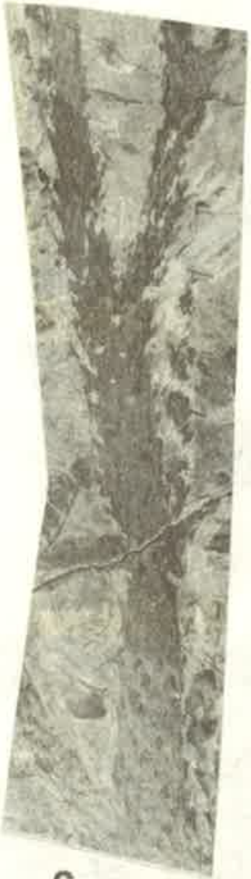
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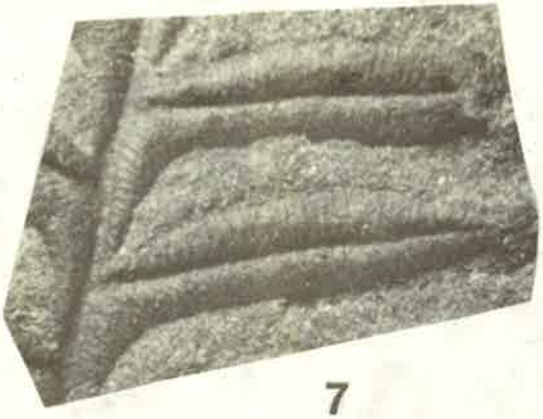
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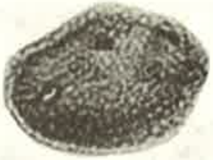
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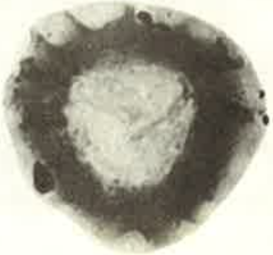
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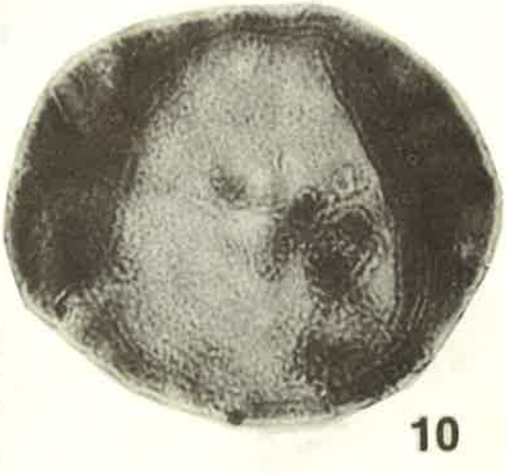
10

Plate 2

TLib 2009.7.1121

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Plant fossils of the Pennsylvanian